

CLAIMS

WHAT IS CLAIMED IS:

1 39. (New) A method for providing precise control of a magnetic coupling field in
2 a NiMn top spin valve head, comprising:
3 forming a copper seed layer on a substrate;
4 forming a free layer on the copper seed layer;
5 forming a non-ferromagnetic layer on the free layer;
6 forming a copper spacer layer on the non-ferromagnetic layer;
7 forming a pinned ferromagnetic layer on the copper spacer layer; and
8 forming a NiMn pinning layer over the pinned ferromagnetic layer;
9 wherein the copper seed layer and copper spacer layer are oxidized separately during
10 formation. .

1 40. (New) The method of claim 39, wherein the forming the copper seed layer
2 comprises depositing a layer of copper as a seed layer and, before depositing a next layer,
3 oxidizing the copper seed layer.

1 41. (New) The method of claim 40, wherein the forming the copper spacer layer
2 comprises depositing a layer of copper as a spacer layer and, before depositing a next layer,
3 oxidizing the copper spacer layer.

1 42. (New) The method of claim 39, wherein the forming the copper spacer layer
2 comprises depositing a layer of copper as a spacer layer and, before depositing a next layer,
3 oxidizing the copper spacer layer.

1 43. (New) The method of claim 39, wherein the copper seed layer and oxidized
2 spacer layer are naturally oxidized for 80 seconds under 8×10^{-5} Torr of oxygen pressure.

1 44. (New) The method of claim 39, wherein the oxidized copper seed layer and
2 oxidized spacer layer reduce the ferromagnetic coupling field without deteriorating GMR
3 effect or resistance.

1 45. (New) The method of claim 39, wherein the oxidized copper seed layer and
2 oxidized spacer layer provide a negative coupling field without affecting GMR effect or
3 resistance.

1 46. (New) The method of claim 39, wherein the oxidized copper seed layer and
2 oxidized spacer layer change the crystalline texture growth of subsequent layers.

1 47. (New) The method of claim 39, wherein the oxidized copper seed layer and
2 oxidized spacer layer provide a negative coupling field that is achieved without affecting a
3 GMR effect or resistance of the NiMn top spin valve head.

1 48. (New) The method of claim 47, wherein the oxidized copper seed layer and
2 oxidized spacer layer provide stronger growth of NiFe(111) and NiMn(111) with respect to
3 NiFe(200) and NiMn(002) phases.

1 49. (New) The method of claim 39, wherein the oxidized copper seed layer and
2 oxidized spacer layer improve the interfacial roughness.

- 1 50. (New) The method of claim 39, wherein the oxidation of the copper seed
- 2 layer and spacer layer does not affect asymmetry performance.